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EFFECT OF MUTAGENIC TREATMENTS OF METHYL GLYOXAL IN PRODUCING HIGH YIELDING MUTANTS IN FINGER MILLET (*ELEUSINECORACANA, GAERTN*)

NIVETHA. C[1], NIVETHA. S[2], PALANI. M[3] & M. SAKILA[4]

[1,2,3]*AnbilDharmalingam Agricultural College and Research Institute , Trichy, Tamil Nadu Agricultural University*

[4]*Agricultural College and Research Institute, Eachangkottai, Thanjavur , Tamil Nadu Agricultural University*

ABSTRACT

An investigation was carried out in CO 13 finger millet variety to develop the mutants for desirable traits. Healthy and dry seeds were exposed to Methyl glyoxal at various concentrations viz., 0.015, 0.03,0.045 and 0.06. M_1 was raised for all concentrations and all the plants in M_1 were forwarded to M_2 generation. Different morphological mutants such as modified earhead, earhead with more fingers, curled stem and leaf were observed in M_2 generation at 0.03% concentration. One hundred mutants were selected in M_2 and1 00 M_3 family rows were raised and evaluated for yield and its characters along with check (untreated CO 13) and in sodicity condition. Among these, nine mutants (M29,M30,M31,M40,M55,M67,M74,M88 andM100) were selected based on yield and early duration.

KEYWORDS: Mutation, Methyl Glyoxal Finger Millet & Yield

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Original Article

INTRODUCTION

Finger millet (*Eleusinecoracana* (L) *Gaertn*) is still considered as a staple food in many rainfed, hilly and tribal areas of India. Tamil Nadu occupies second place in respect of area (7.52%) and production (14.60%) of ragi in India next to Karnataka state. The chief producers are Coimbatore, Erode, Krishnagiri Dharmapuri, Ramanathapuram, Salem, North and South Arcot, Nilgiris, Chinglepet and Madurai Districts. The area under finger millet was 2.33 lakh hectares in 1983 - 84 with a production of 3.05 lakh tonnes and declined to 0.82 lakh hectares (Season and Crop Report 2010) with decreased production of 1.6 lakh tonnes.

But with the year of 2011, millet cultivation is in increased mode, as finger millet is one of the major crops due to promotional activities of millets done both by the Tamil Nadu Government and Tamil Nadu Agricultural University. They are less water intensive and short term crops. Even if crop fails, the plant can be used as a fodder crop. Still then, there is a huge demand as we need to focus on increasing the production of millet. In earlier days,finger millet were cultivated as a rainfed crop and bund crop. Now the trend is gradually changing due to increasing demand and good price which is the encouraging factors. Millet crops are costlier than rice and almost all the shops have stocked them. There was time people looked down upon millet eaters as it was cultivated in backward areas of the state.

It is a hardy crop with minimum disease and pest problems and assures reasonable economic return even under adverse growing conditions. It has been found that protein of finger millet is biologically complete as in the

case of milk. In addition, high calcium, high soluble fibre and polyphenol, high digestive power of malted grains coupled with starch that is more resistant to hydrolysis compared to other cereals, accord finger millet, a unique status food grains. Thus, finger millet can be used for producing a variety of nutritionally designed foods from infants to adults.

Several factors *viz*.,abiotic and biotic stresses, loss of genetic diversity, water shortages and so on are responsible for having a negative impact on food production. Hence, genetic variability is highly desirable for developing new cultivars, which is induced by mutagen treatments and natural spontaneous changes. The spontaneous mutation rate is pretty low and can't be exploited for breeding and that is why artificially mutations are induced with physical and chemical mutagen treatment. (Mohan Jain and Suprasanna,2011).

In Tami Nadu, the area under salinity is 0.43 lakh hectares while the alkali soil constitutes about 3.54 lakh hectares. The seawater intrusion, urbanization and over exploitation of ground water leads to increased soil salinity in the state. Because of these factors, an attempt was made to evolve superior finger millet variety for salt affected soils.

Many popular varieties of finger millet being grown all over Tamil Nadu, suitable varieties for salt affected soils has not been evolved so far. Though TRY 1 Ragi variety was released for sodicity tolerance in 1987,its yield potential has considerably reduced. Hence, the present situation is warranted to develop a high yielding finger millet variety with sodicity tolerance to increase the production and productivity of finger millet in Tamil Nadu. Under these circumstances, the present mutation breeding investigation, aimed to report the effect of methyl glyoxal on mutation frequency and spectrum in an established variety of finger millet CO13 for the development of high yielding mutants

MATERIALS AND METHODS

The experiment was conducted in the laboratory of the Department of Plant Breeding and Genetics, AnbilDharmalingam Agricultural College and Research Institute, Tiruchirapalli,Tamil Nadu Agricultural University during 2014 kharif season. Healthy and dry seeds were exposed to methyl glyoxal at various concentrations 0.015, 0.03,0.045, and 0.06. M_1 was raised in all concentrations. All the plants in M_1 were forwarded to M_2 generation. One hundred mutants were selected in M_2 and100 M_3 family rows were raised with a spacing of 30X10cm in a plot size of 0.9 X5 m^2 and evaluated for yield and its characters along with check(untreated CO 13) in sodicity condition. The observations recorded were days to flowering, plant height (cm), productive tillers, tillers per plant, finger number, 1000 grain weight (gms), days to maturity and grain yield.

Table 1: The Mutants are Listed below

SI. No	MUTANTS	
1	Shoe flower shaped	
2	Synchronized maturity ear head	
3	Normal ear with short basal finger	
4	Uniform maturity	
5	Short finger	
6	Clustered mutant	
7	Broad width ear	
8	Bibranched with lateral pending finger	
9	Tulip shaped finger	
10	Catabelt shaped finger	
11	Clustered ear head with miniature size finger	

Table 1: Contd.,		
12	Medium size finger	
13	Normal to slightly change	
14	Small ear	
15	Long ear	
16	Long finger with one short finger	
17	Peel shaped finger	
18	Miniature finger	
19	Lateral sword shaped ear with short finger	
20	Lateral ear head with 2/3 fingers	
21	Torch shaped	
22	Dark brown seeds	

1. Clustered finger
2. Cluster finger
3. Clustered finger
4. Long ear
5. Normal to slightly change
6. Small clustered finger
7. Clustered finger with short finger
8. Long finger
9. Normal to slightly change
10. Normal to slightly change
11. Normal to slightly change
12. 10 finger
13. Long finger
14. Clustered
15. Normal to slightly change
16. Long
17. Long ear head with short finger
18. Normal to slightly change
19. Lengthy finger
20. Clustered finger
21. Long finger (no economic seed set)

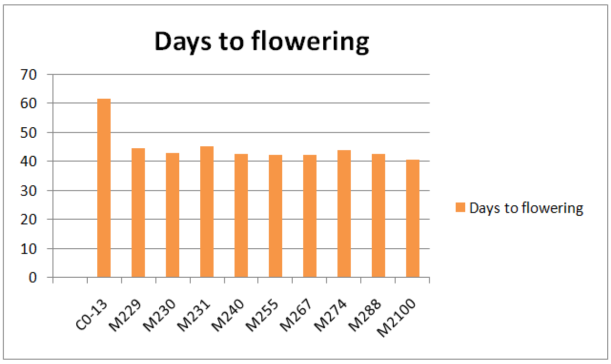
22. Base cluster finger
23. Cup shaped finger
24. Cluster (no economic seed set)
25. Short lateral finger
26. Clustered base finger with perpendicular finger
27. Clustered with mini finger at the base
28. Clustered finger
29. Small finger
30. Long finger
31. Short finger
32. Two branched clustered finger
33. Finger (curved)
34. Long finger with mini fingers
35. Normal to slightly change
36. Clustered finger
37. Long bending finger
38. Shoe flower shaped finger
39. Lateral finger
40. Double branched ear
41. Little fingered ear
42. Torch shaped ear
43. Normal to slightly change
44. Broad width ear
45. Normal to slightly change
46. Clustered with few fingers
47. 8 lean fingers
48. Clustered
49. Pea comb finger with 10 cm length
50. Long finger

51. Clustered finger
52. Medium finger
53. 11 finger
54. Long finger with base mini finger
55. Lengthy (10.5cm) finger
56. Dense finger (base) with top sparse finger
57. More carts at uniform maturity
58. 12 lean finger
59. Clustered finger
60. Clustered (no economic seed set)
61. 11 finger
62. Long finger with small seeds
63. Clustered (no economic seed set)
64. Normal to slightly change
65. Short finger
66. Thick finger
67. Clustered finger
68. Sparse fingers
69. Clustered finger
70. Long finger
71. Broad base finger
72. Normal to slightly change
73. Clustered with few fingers
74. 8 lean fingers
75. Clustered
76. Pea comb finger with 10 cm length
77. Long finger

RESULTS AND DISCUSSIONS

In CO 13 variety, days to flowering was recorded on 60-62 days. Among the mutants, M100 recorded minimum number of days to flowering (40 days) and M31 recorded maximum number of days to flowering(45days). Early flowering

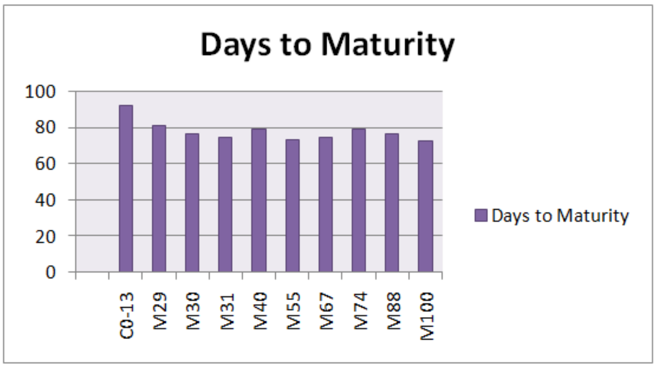
and maturity may be due to sudden mutagenic changes caused by methyl glyoxal. This result is in agreement with results obtained by Nirmalakumari et al., (2007) in little millet.



Figure

In CO 13, days to maturity was at 70 days. In M100 mutant, minimum number of days to maturity (71) dayswas recorded and M29 mutant recorded maximum number of days to maturity (81 days). Early flowering and maturity may be due to sudden mutagenic changes caused by methyl glyoxal.

The present study coincides with a previous study in finger millet by Ambavanae*et al*.(2015)who reported the significant change in maturity.



Figure

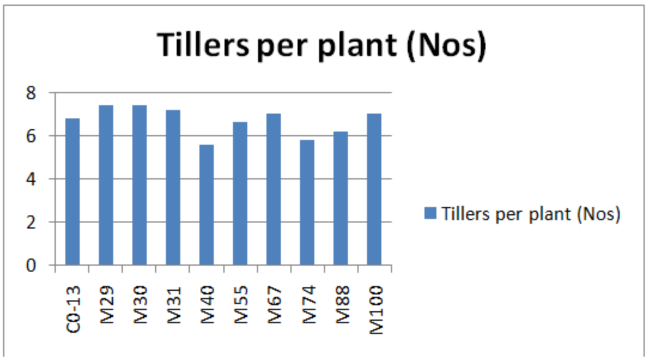
The maximum plant height of 95 cm is at maturity was observed in M100 mutant. When comparing with the variety (plant height= 85.2cm), and M74 mutantobserved minimum plant height of 60.2 cm.

The present study coincides with a previous study in finger millet by

Ambavanae *et al.(*2015) who reported significant change in flowering, maturity and plant height character and few of them have good breeding value.

Maximum number of tillers (6.8) was recorded in the variety CO13. The treated M29 and M30 mutants show maximum number of tillers (7.4) and M40 mutant show minimum number of tillers(5.6) compared with variety.

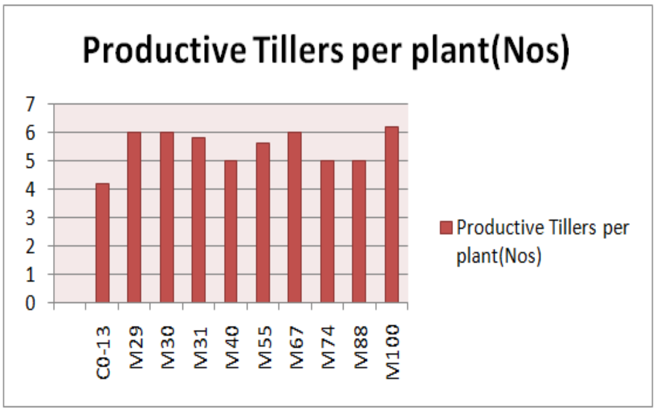
Muduli and Misra (2007) produced productive mutants showed diverse changes in characters such as, days to flowering, days to maturity, height and other direct yield components like tiller number, fingers/ear, finger length and 1000-grain weight.



Figure

M100 mutant recorded that maximum number of productive tillers per plant (6.2) while considering the number of productive tillers per plant of control (4.8)

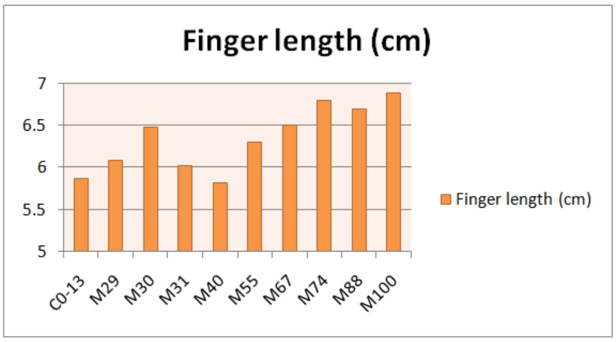
Muduli and Misra (2007) observed plant characters changes with mutagens, their doses and the crop variety and changes occurred in productive tillers/plant. These morphological changes in M_3 generation could be considered to be the secondary effect due to the sudden changes in the mutants.



Figure

It could be seen that the maximum length of fingers (6.88cm) in M100 mutant was observed in when considering the length of fingers of control (5.86), Different mutants showed a reduced length of fingers.

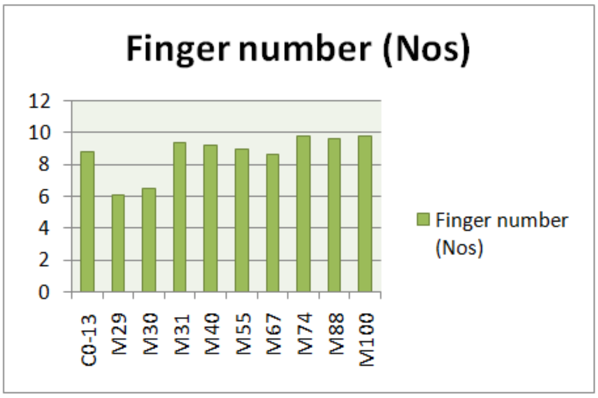
Muduli and Misra (2008) reported that the increase in doses of mutagen affects the decreased. fingerlength Ear head length and finger length had significant positive association with grain yield.



Figure

The number of fingers per plant and untreated plants was counted. Maximum number of fingers(9.8) was observed in M100 and M74 mutant

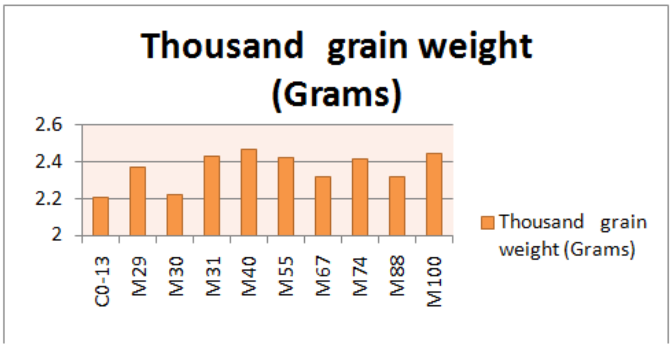
Methylglyoxal treatments exhibited a positive effect on this trait compare to control(8.8). This gives the increased yield of grain per plant.



Figure

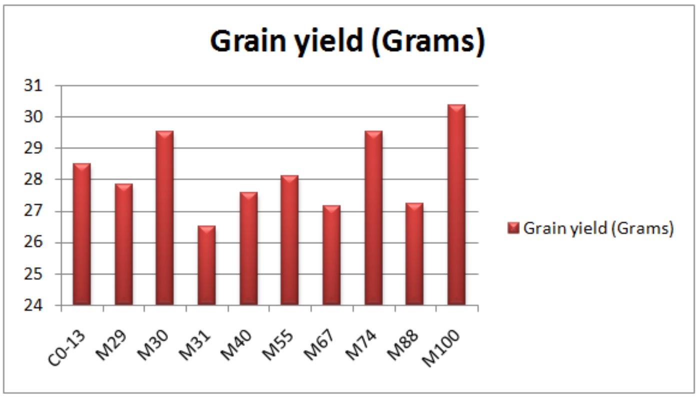
The thousand grain weight was observed for the control 2.21grams. The increased grain weight was observed in M40 mutant (2.468grams). Hence it increases the plant yield too.

The present study coincides with previous study in finger millet by Muduli and Misra (2008). who observed plant characters changes with mutagens, based on their doses and the crop variety. The changes occurred in grain weight/and yield.



Figure

The present study coincides with previous study in finger millet by Muduli and Misra (2008). who observed plant characters changes with mutagens, based on their doses and the crop variety. The changes occurred in grain weight/and yield. Maximum grain yield of 30.34 grams was observed in the M100 mutantthan control (28.9)gramswas recorded. Kadkol and SwaminathanM(1954)reported that the grain yield of plants germinated from the seeds treated with EMS and gamma rays were gradually decreases while the concentration increases. This study shows the effect on mutation treatment on grain yield.



Figure

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